

9/pts

1

# METHOD FOR PRODUCING INTEGRATED SEMICONDUCTOR COMPONENTS

The present invention is directed to a method for producing an integrated semiconductor component. In particular, the present invention is directed to a method for producing and integrated DRAM or embedded DRAM or, respectively, embedded SRAM semiconductor component.

The goal of many developments in microelectronics is to constantly lower the costs to be expended for the realization of a specific electronic function and, thus, to constantly increase the productivity. The guarantee for increasing productivity in recent years was and is, thereby, the constant structural miniaturization of the semiconductor components. In particular, field effect transistors are being constantly miniaturized and arranged in integrated circuits having the highest packing density.

In order to carry out their function, field effect transistors must be connected to other field effect transistors and to the outside world. To that end, contacts to the diffusion regions of the transistors must be produced. In methods for manufacturing logic circuits, for example, via holes to the diffusion regions of the transistors are produced by a photo technique and an etching. Since this formation of the via holes is usually not implemented self-aligned, an adequately large safety margin between the gate track and the via hole must be adhered to; this, of course, has a negative influence on the integration density.

In methods for producing DRAM semiconductor components, self-aligned contacts are usually produced. Via holes are thereby usually etched in a BPSG layer deposited between the gate paths. Subsequently, these via holes are filled with a conductive material, so that a conductive connection is created.

The production of these via holes, however, becomes more and more difficult with ongoing structural miniaturization. In modern field effect transistors, a number of spacers are produced at the sidewalls of the gate webs, these, in interaction with suitable dopant implantations, seeing to it that it dopant profiles suitable for the respective purpose can be produced in the source/drain regions. Due to the spacers arranged between the gate paths and the demand that the via hole should be arranged

10048207.012302

between the spacers insofar as possible, the distance between the gate paths or, respectively, the diffusion region that serves the purpose of contacting must be selected adequately large, this having a negative influence on the integration density that can be achieved.

5               When etching the via holes, the gate paths dare not be damaged, since a short would otherwise arise between the diffusion contact and the gate. Since, despite all efforts, one cannot prevent the gate paths from being attacked when etching the via holes, a thick protective layer, was referred to as a "cap", is usually arranged on the gate paths, this being intended to prevent a short between contact and gate. The  
10               relatively great thickness of this protective layer, however, deteriorates the quality of the gate paths and usually prevents a silicidization of the gate paths as well as the subsequent doping of the polysilicon of the gate paths (dual work function gate).

              Due to the tight conditions between the gate paths, it is necessary that the insulation layer be subjected to a temperature treatment at relatively high temperatures  
15               in order to achieve a flowing of the insulation layer. Nonetheless, holes, what are referred to as voids, can occur between the gate paths in the deposition of the insulation layer. When the via holes are then formed, it can occur that two via holes are connected to one another via a void. In the subsequent filling of the via holes with conductive material, the voids are usually also filled, so that a short between two  
20               contacts can arise that possibly leads to the outage of the entire circuit.

              It is therefore the object of the present invention to offer a method for producing an integrated semiconductor component that minimizes or, respectively, entirely avoids said problems.

              This object is inventively achieved by the methods for producing an  
25               integrated semiconductor component according to independent patent claims 1 or 3. Further advantageous embodiments, properties and aspects of the present invention derive from the dependent claims, from the specification and from the attached drawings.

              Inventively, a method for producing an integrated semiconductor  
30               component is offered that comprises the following steps:

- 5
- a) a semiconductor substrate having at least one first region and at least one second region is prepared;
  - b) gate paths are produced in the first and in the second region of the semiconductor substrate;
  - c) source/drain regions neighboring the gate paths and at least two spacers at the gate paths are produced in the first region of the semiconductor substrate;
  - d) source/drain regions are produced neighboring the gate paths in the second region of the semiconductor substrate, and contacts to predetermined source/drain regions are formed before all spacers have been produced in the first region of the semiconductor substrate.
- 10

Inventively, a method for producing an integrated semiconductor component having the following steps is also offered:

- 15
- a) a semiconductor substrate having at least one first region and at least one second region is prepared;
  - b) gate paths are produced in the first and in the second region of the semiconductor substrate;
  - c) source/drain regions neighboring the gate paths as well as at least two spaces at the gate paths are produced in the first region of the semiconductor substrate;
  - d) source/drain regions neighboring the gate paths are produced in the second region of the semiconductor substrate, and contacts to predetermined source/drain regions are prepared before all spacers in the first region of the semiconductor substrate have been produced.
- 20
- 25

The inventive methods have the advantage that integration density in the second region of the semiconductor substrate can be noticeably increased. As a result of the feature that the formation of the contacts to the source/drain regions is undertaken or, respectively, readied in the second region of the semiconductor substrate at a time at which all spacers have not yet been produced, no unnecessary

30

spacer production occurs in the second region, as a result whereof chip area can be saved. The saved area can, for example, be used in order to arrange the gate paths closer together in the second region. The spacers can thereby be employed as an aid for setting the desired dopant profiles and/or as lateral insulation of the gate paths.

5 Further, the inventive methods can be integrated without difficulty in a process sequence that already exists for producing a semiconductor component. In particular, the process steps for the manufacture of very fast logic circuits can be retained nearly unmodified. Problems such as derive at traditional methods due to the occurrence of voids between the transistors can be clearly reduced or, respectively,  
10 entirely avoided given the inventive methods. Due to the early formation or, respectively, preparation of the contacts, high aspect ratios can be avoided, as a result whereof, the processes can be implemented more stably overall. The contacts can thereby also already be formed or, respectively, prepared at a time at which the source/drain regions have not yet been formed at all.

15 According to a preferred embodiment, landing pads are formed in the second region of the semiconductor substrate for preparing the contacts to predetermined source/drain regions. Doped polysilicon is preferably employed for forming the landing pads or, respectively, the contacts themselves.

According to another preferred embodiment, sacrificial contacts are  
20 formed in the second region of the semiconductor substrate for preparing the contacts to predetermined source/drain regions. The sacrificial contacts likewise prevent the production of unnecessary spacers at the gate paths in the second region of the semiconductor substrate. They are removed only when the actual contacts to the source/drain regions are formed.

25 According to a preferred embodiment, the spacers are formed of silicon oxide, silicon nitride or oxynitride. To that end, a silicon oxide layer, silicon nitride layer or oxynitride layer is deposited over the gate paths and etched back with an anisotropic etching, so that parts of these layers remain at the sidewalls of the gate paths. By employing these spacers, the dopings of the source/drain region can be set  
30 very precisely corresponding to the respective demands.

10040207 012802

According to another preferred embodiment, the gate paths are formed in that a polysilicon layer and a protective layer, particularly a silicon nitride layer, silicon oxide layer or oxynitride layer is produced and these layers are structured in common to form gate paths. It is thereby particularly preferred when the protective layer is produced with a thickness such that the protective layer comprises a thickness less than 100 nm, preferably between 40 and 60 nm, after the gate structuring. This protective layer is frequently referred to as "cap" and, in traditional processes, serves among other things as a hard mask for gate structuring and for protecting the gate paths in an etching process for producing the via holes. In the prior art, a dry-etching process that etches oxide selectively relative to the cap material must be utilized for this purpose. Since the structure to be etched exhibits a high aspect ratio in the prior art, the selectivity of the etching process is not very high, and a relatively thick "cap" must be employed in order to avoid a short between the gate path and the contact.

Since the formation of the contact is already undertaken or, respectively, prepared at a very early stage given the inventive methods, the "cap" now serves only for insulating the gate path from the contact and can therefore be selected relatively thin. Accordingly, the "cap" can be completely removed from the gate paths in the first region in later process steps, for example when etching a nitride spacer, and without additional process steps, this opening up the possibility of doping various gate paths with different dopants and thus constructing what are referred to as dual work function gates. Further, the gate paths can be silicided in this way, as a result whereof the resistance of the gate paths is clearly reduced.

It is also preferred when the gate paths in the first region of the semiconductor substrate are doped with dopants having different conductivity types. As a result of what is referred to as these dual work function gates, extremely high-performance logic circuits can be constructed. In this way, the supply voltage can also be reduced without incurring any losses in the switching speed.

For reducing the resistances of the gate paths, it is preferred when silicide layers are produced on the gate paths in the first region of the semiconductor substrate. In particular, it is preferred when  $\text{CoSi}_2$ ,  $\text{TaSi}_2$ ,  $\text{TiSi}_2$  or  $\text{WSi}_x$  is employed as silicide layers, and these silicide layers are produced by a silicide method.

The invention is explained in greater detail below with reference to the drawings. Shown are:

- Figs. 1 - 8            a method according to a first exemplary embodiment of the present invention;
- 5    Figs. 9 - 12        a method according to a second exemplary embodiment of the present invention;
- Figs. 13-18          a method according to a third exemplary embodiment of the present invention, [sic]

10                      Figures 1 through 8 show a method according to a first exemplary embodiment of the present invention. A thin silicon oxide layer was produced on a silicon substrate 1. This silicon oxide layer, that is not shown in Fig. 1, serves as gate oxide during the further course of the method. Dependent on the application, silicon oxide layers of different thicknesses are employed in different regions of the silicon substrate. A polysilicon layer 2 is arranged on the silicon oxide layer. In this  
15                      embodiment of the present invention, the polysilicon layer 2 was deposited as an undoped polysilicon layer, this being subsequently doped with the assistance of a photo technique. A silicon nitride layer 3 is arranged above the polysilicon layer 2. The thickness of the silicon nitride layer 3 thereby amounts to approximately 50 nm after the gate structuring. During the further course of the method, this layer serves as  
20                      what is referred to as a "cap nitride".

Before producing the silicon oxide layer, a n-well 4 or, respectively, p-wells 5, 6 were produced in the silicon substrate. The individual wells are separated from one another by isolations 7. In the present example, these isolations 7 are fashioned as what are referred to as shallow trench isolations. The first region 8 of the  
25                      silicon substrate 1 is arranged at the left side of Fig. 1. In this first region 8, the transistors from which the logic circuit is constructed are produced later. The second region 9 of the silicon substrate 1 is arranged at the right side of Fig. 1. In this second region 9, the transistors that serve as selection transistors in the memory cells are produced later.

30                      Subsequently, the silicon nitride layer 3 and the polysilicon layer 2 are structured to form gate paths 10 with a photo technique. A re-oxidation of the gate

oxide ensues in order to eliminate possible defects that occurred in the etching of the silicon nitride layer 3 and of the polysilicon layer 2. Phosphorous is now implanted into the silicon substrate with a photo technique for producing what are referred to as the source/drain regions 11 of the n-channel transistors. After this implantation, a

5 further silicon nitride layer is deposited and is structured with an anisotropic etching. First insulating spacers, what are referred to as spacers 12, arise at the sidewalls of the gate paths 10 as a result of this etching. After producing the spacers 12, boron is implanted in the silicon substrate with a photo technique, so that the p-channel transistors can also be produced. Subsequently, a further silicon nitride layer 13 is

10 deposited. The situation deriving therefrom is shown in Fig. 2.

The transistors that are produced in the second region 9 of the silicon substrate 1 serve as selection transistors in the memory cells. The capacitors of the memory cells, which are formed as trench capacitors in the present example, are not shown in the Figures for reasons of clarity. A high integration density arises

15 particularly in the second region 9 of the silicon substrate 1. In order to be able to achieve this high integration density, a resist mask is produced that is opened at the locations at which the source/drain terminals, i.e. the terminals for the bit lines, the selection transistors, are produced later. The silicon nitride layer 13 in the opening 14 of the mask 15 is removed with an anisotropic etching, and so that the source/drain

20 regions 11 of the selection transistors are uncovered. The first region 8 of the silicon substrate 1 is thereby protected by the resist mask 15 and thus experiences no modification. Subsequently, the resist mask 15 is removed and a further polysilicon layer 16 is deposited. This polysilicon layer 16 is a matter of a doped polysilicon layer. The situation deriving therefrom is shown in Figure 4.

25 The polysilicon layer 16 is now structured with the assistance of a further photo technique. The polysilicon layer 16 is thereby completely removed from the first region 8 of the silicon substrate 1. The remaining part of the polysilicon layer 16 forms what is referred to as a "landing pad" 17 in the second region 9 of the silicon substrate. The situation deriving therefrom is shown in Fig. 5.

30 Subsequently, a further silicon oxide layer is deposited. This silicon oxide layer is structured such with a further anisotropic etching that a further spacer 18

arises at the sidewalls of the gate paths 10 in the first region 8 of the silicon substrate. As a result of the sequence of these spacers 12 and 18 at the sidewalls of the gate paths 10 in the first region 8 of the silicon substrate and suitably selected dopant implantations, the source/drain regions 11 of the transistors in the first region 8 can be set such that transistors having extremely short switching times can be produced. Accordingly, extremely high-performance logic circuits can be constructed. Due to the polysilicon layer 16, no deposition of the silicon oxide layer between the gate paths of the selection transistors occurs in the second region 9 of the silicon substrate. Accordingly, silicon oxide spacers 18 are also not produced between the gate paths 10 of the selection transistors. The area that is thereby saved between the gate paths of the selection transistors can be used in order to arrange the gate paths correspondingly closer together, as a result whereof the integration density in the memory cell field is increased.

The remaining part of the silicon nitride layer 3 on the gate paths 10 in the first region 8 of the silicon substrate is removed with a further etching. This is possible because the silicon nitride layer 3 exhibits an extremely slight thickness in comparison to traditional methods. As a result of the removal of the silicon nitride layer 3, the gate paths 10 can now be doped in the desired type and fashion. A different doping of the various gate paths 10 is also possible in a simple way (dual work function gates). In this way, extremely fast logic circuits can be produced. The situation deriving therefrom is shown in Fig. 6.

Subsequently, a silicide-forming metal, for example tantalum, titanium, tungsten or cobalt, is sputtered on. A silicide reaction occurs on the uncovered silicon regions as a result of a thermal treatment, namely the gate paths in the first region as well as the uncovered source/drain regions, whereas the silicide-forming metal is preserved essentially unmodified in the other regions and can thereby be removed in turn in a simple way. The results are selective and self-aligned silicide layers 19 on the gate paths in the first region 8 and the uncovered source/drain regions 11 ("salicide method"). The resistance of the gate paths 10 is clearly reduced by the silicide layers 19, this having a positive influence on the performance capability of the logic circuit. Further, the silicidation of the source/drain regions 11 clearly lowers the

contact resistance, this likewise having a positive influence on the performance capability of the logic circuit.

Subsequently, a thin silicon nitride layer is deposited, this serving as barrier. For reasons of clarity, this thin silicon nitride layer is not shown. This is followed by the deposition of BPSG layer 20 that is planarized by a CMP step. A thermal treatment is implemented before the CMP step, so that the BPSG layer 20 can fill out the interspaces between the transistors as well as possible. The situation deriving therefrom is shown in Fig. 7.

Via holes 21 are now produced in the BPSG layer 20 with a further technique. These via holes 21 lead both to the silicon substrate 1 as well as to the gate paths 10. In the second region 9 of the silicon substrate, the via hole is conducted to the polysilicon layer 16 that serves as landing pad 17. After deposition of what is referred to as a liner (not shown), the via holes are filled with tungsten, and a CMP step is implemented in order to remove tungsten from the substrate surface outside the via holes.

For a complete production of the integrated circuit, the metalization as well as the passivation are subsequently constructed with a number of known steps. The inventive method has the advantage that the integration density in the second region of the semiconductor substrate can be clearly increased. Over and above this, the properties of the transistors in the first region of the semiconductor substrate can be clearly improved with little added outlay (silicidation, dual work function gates). The present invention, for example, therefore enables the cost-beneficial manufacture of what are referred to as embedded DRAM products.

Figs. 9 through 12 show a method according to a second exemplary embodiment of the present invention. The first steps of this method thereby agree with the steps shown in Figs. 1 through 4 and shall therefore not be repeated here.

In contrast to the first exemplary embodiment of the present invention, a relatively thick polysilicon layer is deposited. The polysilicon layer is structured with the assistance of a further photo technique. The polysilicon layer is thereby again completely removed from the first region of the silicon substrate. The remaining part

of the polysilicon layer forms the complete contact 24 in the second region of the silicon substrate. The situation deriving therefrom is shown in Fig. 9.

A further silicon oxide layer is subsequently deposited. This silicon oxide layer is structured such with a further anisotropic etching that a further spacer 18  
5 arises at the sidewalls of the gate paths 10 in the first region 8 of the silicon substrate. Due to the contact 24, no deposition of the silicon oxide layer occurs in the second region 9 of the silicon substrate between the gate paths of the selection transistors. Accordingly, silicon oxide spacers 18 are also not produced between the gate paths 10 of the selection transistors. The area that is thereby safe between the gate paths 10 of  
10 the selection transistors can be utilized in order to arrange the gate paths 10 correspondingly closer together, as a result whereof the integration density in the memory cell field is increased.

The remaining part of the silicon nitride layer 3 on the gate paths 19 in the first region 8 as well as, partly, in the second region 9 of the silicon substrate is  
15 removed with a further etching. This is possible because the silicon nitride layer 3 exhibits a very slight thickness compared to traditional methods. As a result of the removal of the silicon nitride layer 3, the gate paths 10 can now be doped in the desired way and fashion. A different doping of the various gate paths 10 is also possible in a simple way (dual work function gates). Very fast logic circuits can be  
20 produced in this way. The situation deriving therefrom is shown in Fig. 10.

Subsequently, a silicide forming metal, for example tantalum, titanium, tungsten or cobalt is sputtered on. As a result of a thermal treatment, a silicide reaction occurs on the uncovered silicon regions, namely the gate paths 10 as well as the uncovered source/drain regions 11, whereas the silicide-forming metal remains  
25 essentially unmodified in the other regions and can therefore be simply removed in turn. The result are selective and self-aligned silicide layers 19 on the gate paths 10 and the uncovered source/drain regions 11 ("salicide method"). As a result of the silicide layers 19, the resistance of the gate paths 10 is clearly reduced, this having a positive effect on the performance capability of the logic circuit as well as of the word  
30 lines in the cell field. Further, the contact resistance is clearly reduced due to the

silicidation of the source/drain regions 11, this likewise having a positive influence on the performance capability of the logic circuit.

Subsequently, a thin silicon nitride layer is deposited, this serving as barrier. For reasons of clarity, this thin silicon nitride layer is not shown. This is followed by the deposition of a BPSG layer 20 that is subjected to a thermal treatment so that the BPSG layer 20 can fill out the interspaces between the transistors as well as possible. Subsequently, the BPSG layer 20 is planarized with a CMP step. The CMP step is thereby implanted such that the contact 24 is uncovered. Only the first metallization layer therefore need be deposited in order to produce a conductive connection to the source/drain regions of the selection transistors in the memory cell field. This situation deriving therefrom is shown in Fig. 11.

Via holes 21 are now produced in the BPSG layer 20 with a further photo technique. These via holes 21 lead both to the silicon substrate of the remaining transistors as well as to the gate paths 10. After deposition of what is referred to as a liner (not shown), the via holes are filled with tungsten and a CMP step is implemented in order to remove tungsten from the substrate surface outside the via holes 21. The situation deriving therefrom is shown in Fig. 12.

For complete manufacture of the integrated circuit, the metallization as well as the passivation are built up again with a number of known steps. This inventive method also has the advantage that the integration density in the second region of the semiconductor substrate can be clearly increased. Over and above this, the properties of the transistors in the first region of the semiconductor substrate can be clearly improved with a slight added outlay (silicidation, dual work function gates).

Figures 13 through 18 show a method according to a third exemplary embodiment of the present invention. In contrast to the first exemplary embodiment of the present invention, however, the polysilicon layer does not serve as landing pad but what is referred to as a sacrificial contact.

A thin silicon oxide layer is produced on a silicon substrate 1. This silicon oxide layer, which is not shown in Figure 13, serves as gate oxide during the further course of the method. A polysilicon layer 2 is arranged on the silicon oxide layer. In this embodiment of the present invention, the polysilicon layer 2 was deposited as an

undoped polysilicon layer, this being subsequently doped with the assistance of a photo technique. A silicon nitride layer 3 is arranged over the polysilicon layer 2. The thickness of the silicon nitride layer 3 thereby amounts to approximately 50 nm.

Before producing the silicon oxide layer, an n-well 4 or, respectively, p-wells 5, 6 are produced in the silicon substrate. The individual wells are thereby separated from one another by isolations 7. These isolations 7 are formed as what are referred to as shallow trench isolations in the present example. The silicon substrate is again divided into a first and into a second region.

Subsequently, the silicon nitride layer 3 and the polysilicon layer 2 are structured to form gate paths 10 with a photo technique. A re-oxidation of the gate oxide follows in order to eliminate possible defects that occurred in the etching of the silicon nitride layer 3 and of the polysilicon layer 2. Phosphorous is now implanted in the silicon substrate with a photo technique in order to produce what are referred to as source/drain regions 11 of the n-channel transistors. A further silicon nitride layer is deposited after this implantation and is structured with an anisotropic etching. First insulating spacers 12 arise at the sidewalls of the gate paths 10 as a result of this etching. After producing the spacers 12, boron is implanted into the silicon substrate with a photo technique, so that the p-channel transistors can also be produced. Subsequently, a further silicon nitride layer 13 is deposited. The situation deriving therefrom is shown in Figure 14.

A further polysilicon layer 16 is subsequently deposited. This polysilicon layer 16 is a matter of an undoped polysilicon layer that later forms the sacrificial contact. The situation deriving therefrom is shown in Fig. 15.

The polysilicon layer 16 is not structured with the assistance of a further photo technique. The polysilicon layer 16 is thereby completely removed from the first region 8 of the silicon substrate 1. The remaining part of the polysilicon layer 16 forms the sacrificial contact 25 in the second region 9 of the silicon substrate. The situation deriving therefrom is shown in Figure 16.

A further silicon oxide layer is subsequently deposited. This silicon oxide layer is structured such with a further anisotropic etching that a further spacer 18 arises at the sidewalls of the gate paths 10 in the first region 8 of the silicon substrate.

Due to the sequence of these spacers 12 and 18 at the sidewalls of the gate paths 10 in the first region of the silicon substrate and suitably selected dopant implantations, the source/drain regions 11 of the transistors in the first region 8 can be set such that transistors having extremely short switching times can be produced. Accordingly, extremely high-performance logic circuits can be constructed. Due to the sacrificial contact 25, no deposition of the silicon oxide layer occurs between the gate paths of the selection transistors in the second region 9 of the silicon substrate. Accordingly, silicon oxide spacers 18 are also not produced between the gate paths 10 of the selection transistors. The area between the gate paths of the selection transistors that is thereby saved can be used in order to arrange the gate paths correspondingly closer together, the integration density in the memory cell field being increased as a result thereof.

The remaining part of the silicon nitride layer 3 on the gate paths 10 in the first region 8 of the silicon substrate is also removed with a further etching. This is possible because the silicon nitride layer 3 exhibits an extremely slight thickness compared to traditional methods. The gate paths 10 can now be doped in the desired way and fashion as a result of the removal of the silicon nitride layer 3. Subsequently, a silicon-forming metal, for example tantalum, titanium, tungsten or cobalt, is sputtered on. As a result of a thermal treatment, a silicide reaction occurs on the uncovered silicon regions, namely the gate paths 10 in the first region 8 as well as the uncovered source/drain regions 11, whereas the silicide-forming metal remains essentially unmodified in the other regions and can thereby be removed in turn in a simple way. The result are selective and self-aligned silicide layers 19 on the gate paths 10 in the first region and the uncovered source/drain regions 11 ("salicide method").

The deposition of a BPSG layer 20 follows, this being planarized with a CMP step. A thermal treatment is implemented before the CMP step so that the BPSG layer 20 can fill up the interspaces between the transistors as well as possible. The situation deriving therefrom is shown in Fig. 17.

Via holes 21 are now produced in the BPSG layer 20 with a further photo technique. These via holes 21 lead both to the silicon substrate as well as to the gate

paths 10. The via hole is conducted to the sacrificial contact 25 in the second region 9 of the silicon substrate. A part of the sacrificial contact 25 and the silicon nitride layer 13 that still remains is removed with a dry-chemical or wet-chemical etching, so that there is now a space for the actual contact. This etching of the sacrificial contact  
5 25 can be implemented with high selectivity relative to the surrounding material.

A deposition of what is referred to as a liner (not shown) and the deposition of a tungsten layer that serves the purpose of filling up the via holes again ensue. In a further CMP step, the tungsten that is located outside the via holes is removed from the substrate surface. The situation deriving therefrom is shown in  
10 Figure 18.

Due to the employment of the sacrificial contact 25, a mask level can be eliminated compared to the first embodiment because the silicon nitride 13 need not be removed with a mask between selection transistors in the second region 9.

### List of Reference Characters

	1	silicon substrate
	2	polysilicon
	3	silicon nitride layer
5	4	n-well
	5	p-well
	6	p-well
	7	insulation
	8	first region
10	9	second region
	10	gate path
	11	source/drain regions
	12	spacer
	13	silicon nitride layer
15	14	opening
	15	resist mask
	16	polysilicon
	17	landing pad
	18	spacer
20	19	silicide layer
	20	BPSG layer
	21	via holes
	22	...
	23	...
25	24	contact
	25	sacrificial contact

**Patent Claims**

1. Method for producing an integrated semiconductor component comprising the steps:

- 5 a) a semiconductor substrate having at least one first region and at least one second region is prepared;
- b) gate paths are produced in the first and in the second region of the semiconductor substrate;
- 10 c) source/drain regions neighboring the gate paths and at least two spacers at the gate paths are produced in the first region of the semiconductor substrate;
- d) source/drain regions are produced neighboring the gate paths in the second region of the semiconductor substrate, and contacts to predetermined source/drain regions are formed before all spacers have been produced in the first region of the semiconductor substrate.
- 15

2. Method according to claim 1, characterized in that polysilicon is employed for forming the contacts to predetermined source/drain regions in the second region of the semiconductor substrate.

3. Method for producing an integrated semiconductor component comprising the steps:

- 20 a) a semiconductor substrate having at least one first region and at least one second region is prepared;
- b) gate paths are produced in the first and in the second region of the semiconductor substrate;
- 25 c) source/drain regions neighboring the gate paths as well as at least two spaces at the gate paths are produced in the first region of the semiconductor substrate;
- d) source/drain regions neighboring the gate paths are produced in the second region of the semiconductor substrate, and contacts to predetermined source/drain regions are prepared before all spacers
- 30

in the first region of the semiconductor substrate have been produced.

4. Method according to claim 3, characterized in that landing pads are formed for preparing the contacts to predetermined source/drain regions in the second  
5 region of the semiconductor substrate.

5. Method according to claim 4, characterized in that polysilicon is employed for forming the landing pads.

6. Method according to claim 3, characterized in that sacrificial contacts are formed for preparing the contacts to predetermined source/drain regions in the  
10 second region of the semiconductor substrate.

7. Method according to one of the preceding claims, characterized in that the spacers are formed of silicon oxide, silicon nitride or oxynitride.

8. Method according to one of the preceding claims, characterized in that the gate paths are formed in that a polysilicon layer and a protective layer, particularly  
15 a silicon nitride, silicon oxide or oxynitride layer, are generated and these layers are structured in common to form gate paths.

9. Method according to claim 8, characterized in that the protective layer is generated with a thickness such that the protective layer exhibits a thickness of less than 100 nm after the gate structuring.

20 10. Method according to one of the preceding claims, the gate paths in the first region of the semiconductor substrate are doped with dopants having different conductivity types.

11. Method according to one of the preceding claims, characterized in that silicide layers are generated on the gate paths in the first region of the semiconductor  
25 substrate.

12. Method according to claim 11, characterized in that  $\text{CoSi}_2$ ,  $\text{TaSi}_2$ ,  $\text{TiSi}_2$  or  $\text{WSi}_x$  are employed as silicide layers.

13. Method according to claim 11 or 12, characterized in that the silicide layers are produced with a silicide method.

THE UNIVERSITY OF CHICAGO